



# Why Lung Cancer Screening Makes Financial Sense: New Results from Actuarial Modeling

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# Disclosures

Bruce Pyenson is a Principal and Consulting Actuary employed by Milliman, Inc. Milliman provides actuarial services to the a broad range of the insurance industry, employers, and the healthcare industry. Milliman receives major funding for these services.

I am participating in a 2014 CME course coordinated by the International Early Lung Cancer Action Program on lung cancer screening.

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# 5 Key Facts about Lung Cancer Screening

## ...to be updated for the Medicare population

- 1 Mortality Facts: Lung cancer is a huge killer! Early stage lung cancer is curable and late stage lung cancer is a quick killer
- 2 Lung cancer risk is concentrated in ex-smokers and smokers
- 3 Lung cancer screening with Low Dose CT Scans can identify early stage lung cancer
- 4 Lung cancer screening is low cost
- 5 Adding smoking cessation to LDCT screening increases the value

**Lung cancer screening has high financial value**

# 1 Mortality Facts: Early stage LC patients have MUCH lower mortality than late stage!

*Mortality Load by Stage*

Race	Sex	Age Group	# Patients	Life Years	IA	± C.I.	IB	± C.I.	IIIB	± C.I.	IV	± C.I.
White	Female	<65	32,408	93,614	6.60	0.25	12.2	0.4	47.90	0.94	97.13	0.87
Black	Female	<65	4,866	12,690	5.63	0.55	8.2	0.4	37.18	1.61	68.46	1.48
Other	Female	<65	3,939	10,909	7.80	0.90	15.2	0.4	63.66	3.54	113.18	2.99
White	Female	65-74	30,915	82,723	3.84	0.11	5.2	0.1	20.94	0.37	34.59	0.31
Black	Female	65-74	2,914	6,877	3.75	0.37	5.2	0.1	16.83	0.81	25.18	0.69
Other	Female	65-74	3,130	8,058	3.89	0.39	5.2	0.1	25.57	1.36	37.75	1.10
White	Male	65-74	27,653	72,767	2.19	0.06	3.2	0.0	7.05	0.10	9.68	0.07
Black	Male	65-74	2,295	4,075	2.30	0.24	2.2	0.0	6.57	0.29	8.64	0.21
Other	Male	65-74	3,377	6,304	2.14	0.20	3.2	0.0	7.59	0.29	10.24	0.23

\* Goldberg, An Actuarial Approach to Comparing Early Stage and Late Stage Lung Cancer, Pop Hlth Mgmnt, 2010

## 2 Concentration of Lung Cancer Risk

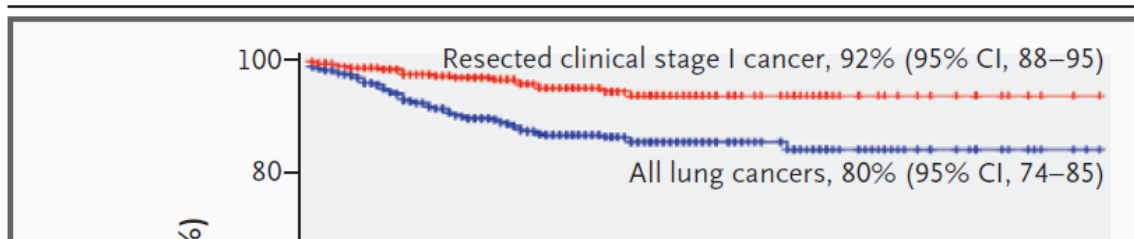
>85% of Lung Cancer occurs among ex-smokers and current smokers

Smokers and Ex-Smokers: between 10% and 30% of population

Contrast concentration of risk to other cancer screening

- Colorectal cancer: All men & women >50
- Breast: All women >40
- Uterine: All women > 18 (with qualifications)

### 3 Screening Detects Early Stage Lung Cx!



	Total	NCN 2–5 mm	NCN 6–10 mm	NCN 11–20 mm	NCN 21–45 mm	Diagnosis		Biopsy not done
						Malignant	Benign	
<b>Recommendation for biopsy</b>								
Based on low-dose CT	5	0	0	0	5*	4	0	1*
Based on baseline high-resolution CT	11	0	2	9*	0	9	1*	1*
Based on follow-up high-resolution CT showing growth	14	1	12	1	0	14	0	0
Not recommended; no growth	3	2	1	0	0	0	3	0
<b>Total</b>	<b>33</b>	<b>3</b>	<b>15</b>	<b>10</b>	<b>5</b>	<b>27</b>	<b>4</b>	<b>2</b>

NCN=non-calcified nodules. \*Identifies nodules for which final diagnosis was benign or the biopsy was not done.

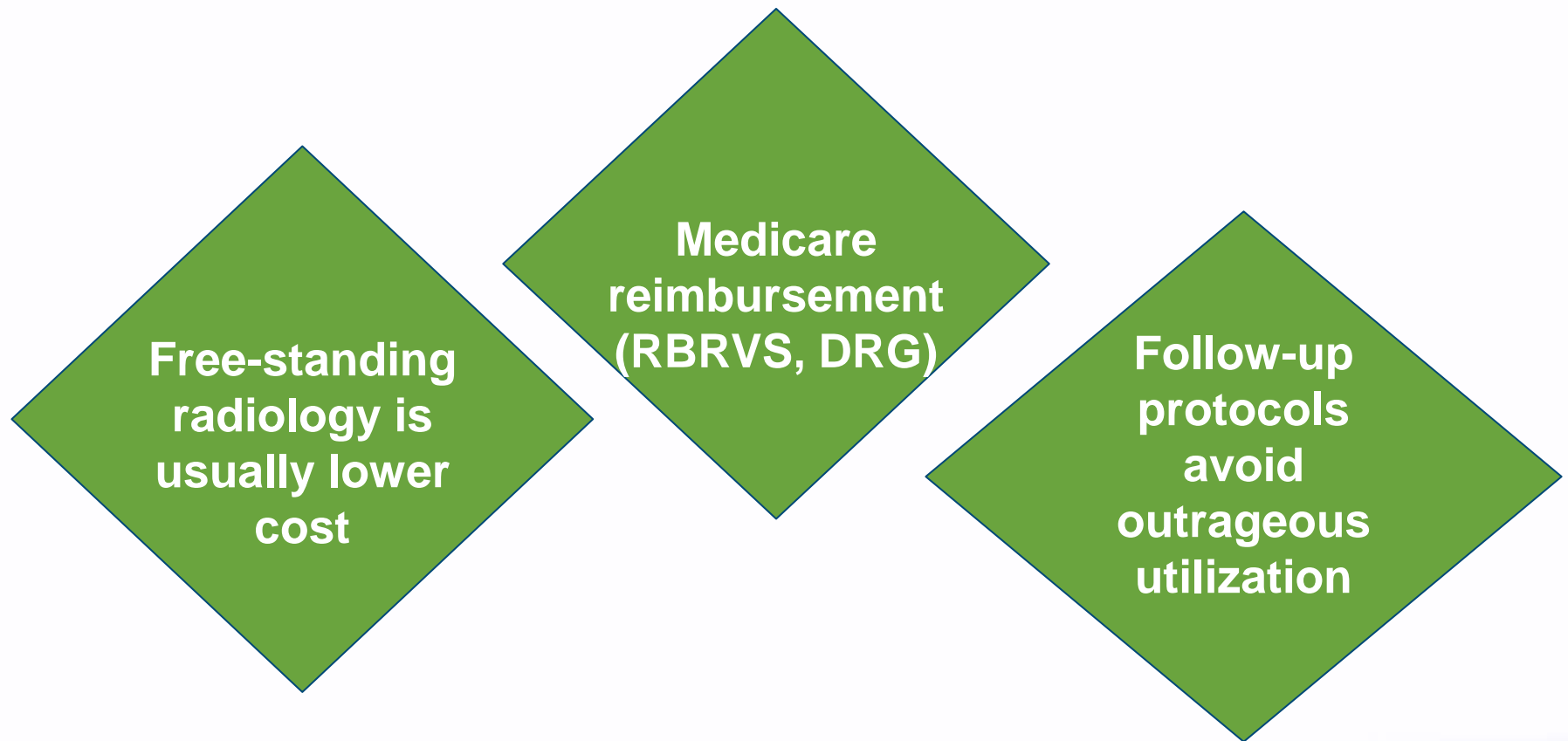
Participants 302 280 242 191 120 59 34 18 12 7 1  
undergoing  
resection

\* Henschke C, Lancet, Jul 10, 1999

**Figure 2. Kaplan–Meier Survival Curves for 484 Participants with Lung Cancer and 302 Participants with Clinical Stage I Cancer Resected within 1 Month after Diagnosis.**

The diagnoses were made on the basis of CT screening at baseline combined with cycles of annual CT.

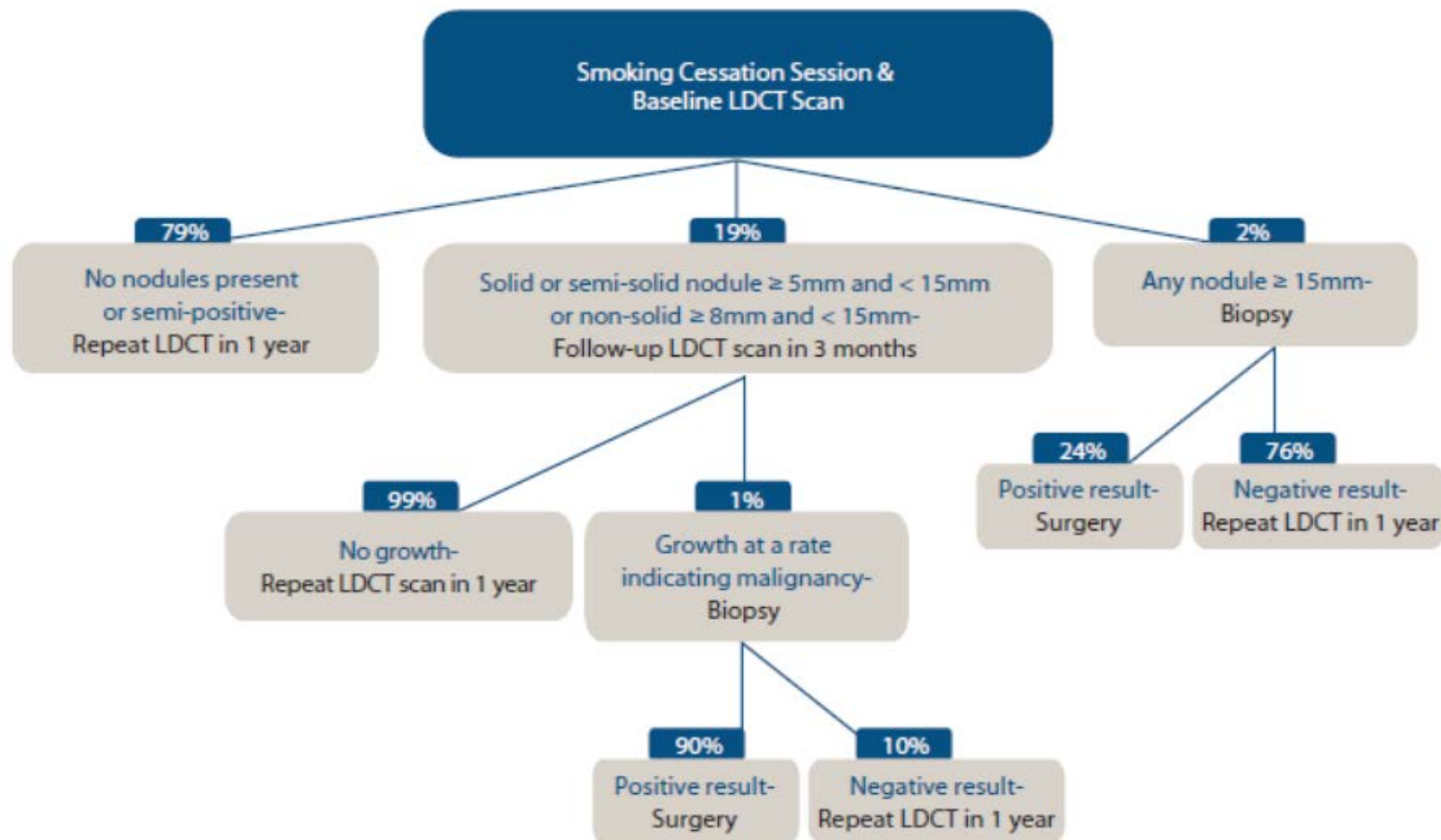
## 4 Lung Cancer Screening is Low Cost



# How Much Does it Cost to Screen One Patient?

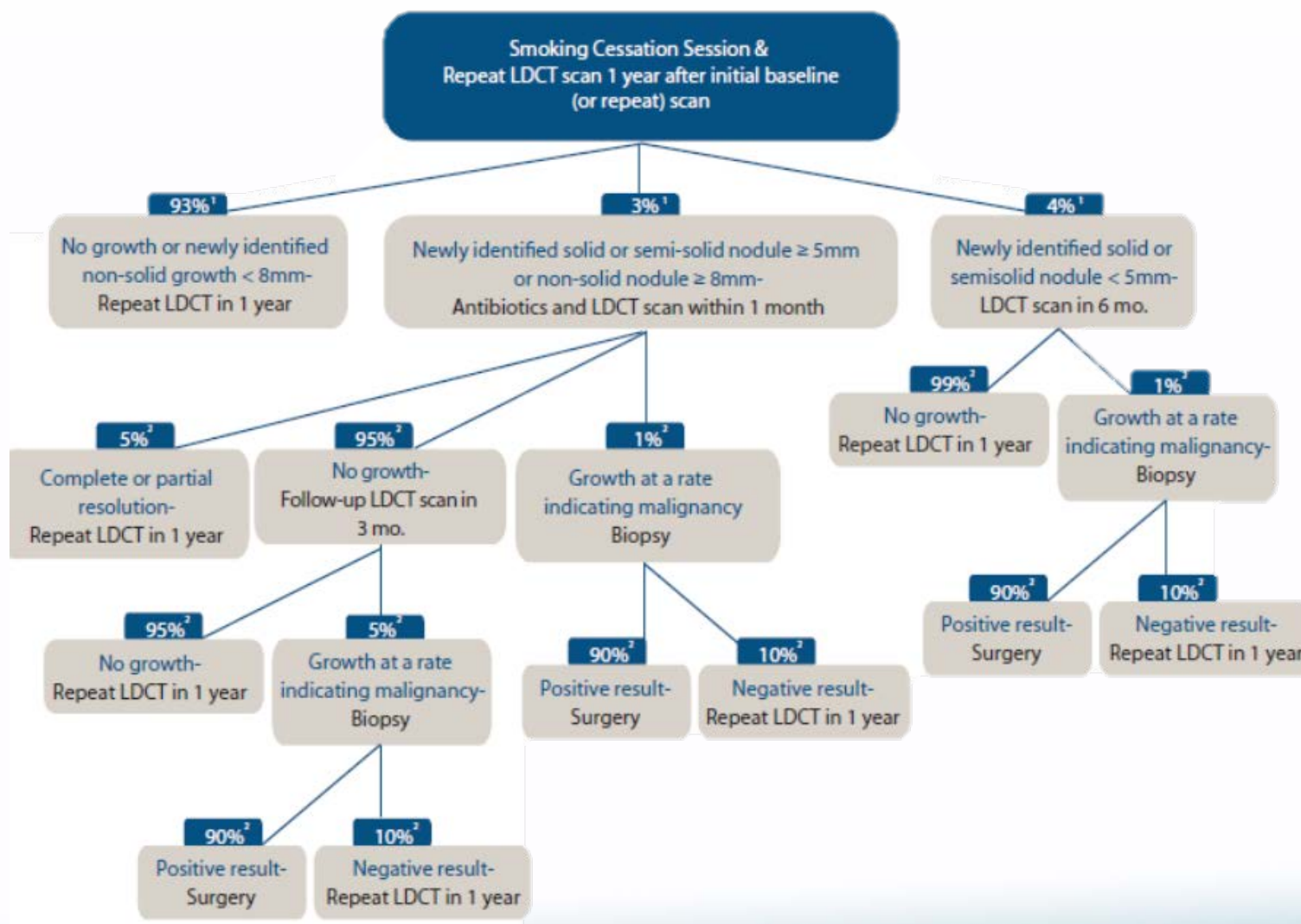
1. LDCT
2. Work-up based on the results of the LDCT

# 1<sup>st</sup> Step in Setting Prices: Baseline Decision Tree for Screening and Diagnosis of Lung Cancer



\*Health Affairs, April 2012. Authors: B Pyenson, M Sander, Y Jiang, H Kahn, J Mulshine

# Repeat Decision Tree



\*Health Affairs, April 2012. Authors: B Pyenson, M Sander, Y Jiang, H Kahn, J Mulshine

## 2<sup>nd</sup> Step in Setting Prices: The Services in Screening Follow-up

Option 1 (60%)	Code
Fine needle biopsy with imaging guidance	10022
Anesthesia units	00520: 5 base units, 3 time units
Fine needle interpretation	88173
Fine needle evaluation	88172
CT- guidance—radiology	77012
Facility charge	APC: 0004
Low-level visit with primary care physician	99212
Option 2 (5%)	Code
Bronchoscopy biopsy	31628
Facility charge	31628
Low-level visit with primary care physician	99212
Option 3 (20%)	Code
VATS wedge resection	32657
VATS lobectomy	32663
Interpretation	88104, 88106, 88107, 88108
Anesthesia units	00528, 00529, 11 base units, 3 time units
Facility charge	DRG 165
Hospital visits	33231
Low-level visit with primary care physician	99212
Option 4 (15%)	Code
Thoracotomy incision	32095
Thoracotomy excision	32100, 32400, 32402, 32405
Interpretation	88104, 88106, 88107, 88108
Anesthesia units	00528, 00529, 11 base units, 3 time units
Facility charge	APC: 0069
Low-level visit with primary care physician	99212

*\*Health Affairs, April 2012. Authors: B Pyenson, M Sander, Y Jiang, H Kahn, J Mulshine*

### 3<sup>rd</sup> Step in Setting Prices: How much \$ for each Service?

<b><u>Option 1:</u></b>			
Fine Needle Biopsy with Imaging Guidance	\$65.57	Source: CPT code 10022, 2011 RBRVS Fee	
Anesthesia	\$168.41	Source: CPT code 00520: 5 base units, 3 time units	
Fine Needle Interpretation	\$137.60	Source: CPT code 88173, 2011 RBRVS Fee	
Fine Needle Evaluation	\$50.62	Source: CPT code 88172, 2011 RBRVS Fee	
CT Guidance - Radiology	\$163.77	Source: CPT code 77012, 2011 RBRVS Fee	
Facility Charge	\$315.75	Source. APC: 0004	
Low-level PCP Visit	\$41.45	Source: CPT code 99212, 2011 RBRVS Fee	
<b>Total</b>	<b>\$943.17</b>		
<b><u>Option 2:</u></b>			
Low-level PCP Visit	\$41.45	Source: CPT code 99212, 2011 RBRVS Fee	
Bronchoscopy Biopsy	\$395.83	Source: CPT code 31628, 2011 RBRVS Fee	
Facility Charge	\$406.83	APC	
<b>Total</b>	<b>\$844.11</b>		

*\*Health Affairs, April 2012. Authors: B Pyenson, M Sander, Y Jiang, H Kahn, J Mulshine*

# Setting Prices

<b>Option 3:</b>				
VATS Wedge Resection	\$1,130.40	Source: Average of CPT code 32663 and 32657, 2011 RBRVS Fee		
Interpretation	\$29.98	Source: CPT codes 88104, 88106, 88107, 88108		
Anesthesia	\$263.14	Source: CPT codes 00528, 00529: 8, 11 base units, 3 time units		
Facility Charge	\$9,916.28	IP Charge - DRG 165		
Hospital Visit	\$168.92	Average LOS for DRG 165 is 4.4 (CPT code 33231)		
Low-level PCP Visit	\$41.45	Source: CPT code 99212, 2011 RBRVS Fee		
Total	<b>\$11,339.80</b>			20%
<b>Option 4:</b>				
Thoracotomy incision	\$647.25	Source: CPT code 32095, 2011 RBRVS Fee		
Thoracotomy excision	\$438.64	Source: CPT codes 32100,32400,32402,32405		
Interpretation	\$29.98	Source: CPT codes 88104, 88106, 88107, 88108		
Anesthesia	\$263.14	Source: CPT codes 00528, 00529: 8, 11 base units, 3 time units		
Facility Charge	\$2,399.79	Source: APC: 0069		
Low-level PCP Visit	\$41.45	Source: CPT code 99212, 2011 RBRVS Fee		
Total	<b>\$3,778.80</b>			15%

# Deliver the Bundle!

All costs for one patient in year following screening through biopsy  
Higher cost for baseline screening than annual repeat screenings  
due to more work-up with baseline

## Average Per Patient Figures from our *Health Affairs* Article

Component	Baseline Fee per Patient per Year	Repeat Fee per Patient per Year
Low Dose CT Scan	\$206	\$206
Work-up	\$70	\$20
Total for year	\$276	\$226

**Note: Figures should vary by geography, practice patterns, and business decisions!**  
Fees shown are national average Medicare from 2011, except for screening LDCT, which is inferred from diagnostic CT of thorax.

# Rider Pricing for Commercial Payers: \$0.76 PMPM

## Per Member Per Month Lung Cancer Screening Costs and Comparisons with Other Cancer Screenings

Scenario description	Lung cancer screening rider PMPM in 2012 dollars (no cost sharing)
Baseline assumptions	\$0.76
25% increase in prices	\$0.95
25% increase in take-up rate	\$0.95
200% increase in follow-up after screening	\$0.96
Other cancer screenings	PMPM in 2006 dollars (after cost sharing)
Breast	\$2.50
Cervical	\$1.10
Colorectal	\$0.95

PMPM is for per member per month.

**SOURCES:** For scenario descriptions: authors' results. For other cancer screenings: Pyenson BS, Zenner P. Cancer screening: payer cost benefit thru employee benefits programs. New York (NY): Milliman; 2005 [cited 2011 Dec 12]. Available from: [http://c-change.together.org/Websites/cchange/Images/Publications%20and%20Reports/Milliman\\_Report.pdf](http://c-change.together.org/Websites/cchange/Images/Publications%20and%20Reports/Milliman_Report.pdf)

**NOTES:** Both the lung cancer screening figures and the 2006 figures for breast, cervical, and colorectal cancer screening include all work-ups to the point of diagnosis. PMPM is per member per month.

## 5 Add Smoking Cessation

**Table 2.** Projected 15-year costs and quality-adjusted life years saved by lung cancer screening and treatment with and without smoking cessation using stage shifts from the NY-ELCAP and NLST in authors' actuarial model.

	NY-ELCAP stage shift	NLST stage shift
<b>Screening</b>		
Lung cancer screening and treatment costs	\$27,824,282,242	\$34,054,299,361
QALYs saved by screening and treatment	985,284	722,795
Cost per QALY saved	\$28,240	\$47,115
<b>Screening + light smoking cessation intervention</b>		
Additional costs for cessation	\$1,361,556,665	\$1,361,556,665
Additional QALYs saved by cessation	273,566	273,566
Cost per QALY saved	\$23,185	\$35,545
<b>Screening + intensive smoking cessation intervention</b>		
<i>A. NRT generic plus behavioral</i>		
Additional costs for cessation	\$3,212,191,737	\$3,212,191,737
Additional QALYs saved by cessation	930,754	930,754
Cost per QALY saved	\$16,198	\$22,537

\*Villanti, AC. PLOS-One, Aug 2013

# Implement LC Screening as an Exemplar of System Change!

- Only best practices for screening, evaluation, follow-up, smoking cessation
- Outcomes measured & published
- Use data for continuous process improvement
- Only by high quality, low cost providers
- Keep pace with computational & through-put revolution in imaging
  - Delivery costs should decrease through higher efficiency

# Summary

Lung cancer screening makes so much economic sense it will be a standard service

Use your high-quality, evidence-based lung cancer screening program to counter low-quality, “cowboy oncology”